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of

Ryan L. Stone

for

REORIENTABLE PULLEY SYSTEM

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BACKGROUND OF THE INVENTION

1. The Field of the Invention

The present invention relates to systems and methods for providing a reorientable pulley system. More specifically, the invention relates to a reorientable pulley system having an articulating arm that is particularly useful as an exercise device for exercising the arms and/or legs of a user.

2. Background and Related Art

Pulleys have traditionally been used to lift objects. A pulley includes a rotable disk that is allowed to spin on its axis and is configured to receive a cord (e.g., a rope or cable) around a portion of the peripheral disk rim. A first end of the cord is fastened to an object that is to be lifted. The opposing end of the cord is threaded around a portion of the rim of the pulley, which is typically coupled to a support above the object, and pulled to cause the cord to move about the disk rim. As the cord moves, the disk spins about its axis. Once the cord tightens, additional pulling on the cord causes the object to be lifted in the direction of the pulley.

A pulley facilitates lifting by changing the direction in which a force is required to be exerted in order to lift an object. Often the ability to pull in a downward direction rather than having to exert force in an upward direction has proven to be more convenient in lifting heavy objects. Pulleys therefore provide a mechanical advantage. Multiple pulleys may be used in a system to facilitate lifting by reducing the force that is required to lift an object.

While pulleys have been used to facilitate lifting by changing the direction of the required force and by reducing the amount of force required, a force is still required to be exerted in a given direction to lift an object. At times it is advantageous to modify the given

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111
TELEPHONE (801) 533-9800

direction of the force exerted. For example, in an exercise device having a reorientable arm, it is often desirable to initially orient the arm in one position for a first exercise (e.g., above the shoulder for arm pull downs) then reorient the arm in a second position for a second exercise (e.g., below the shoulders for arm curls).

However, a number of challenges are encountered in traditional pulley systems. For example, a change in force direction (e.g. rotation of an exercise arm) often lengthens or shortens the cable path of typical systems. For example, as a typical extension arm having a pulley system is rotated, a cord used in the pulley system is often loosened or tightened, depending on the positioning of the extension arm. As a result of the loosening or lengthening, the position of a handle mounted on the cord can change with respect to the end of the arm. In one position, the handle abuts the end of the arm, while in another position the handle droops in an unsightly, inconvenient manner away from the end of the arm.

Thus, it would be an advancement in the art to be able to modify the direction of the force exerted in a pulley system, e.g., for use in exercise equipment and in other disciplines, without affecting the length or tension of the cord path or without providing an otherwise awkward pulley system.

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60 EAST SOUTH TEMPLE
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SUMMARY AND OBJECTS OF THE INVENTION

It is therefore an object of the invention to provide an improved pulley system.

It is another object of the invention to provide a pulley system that can be conveniently reoriented.

It is another object of the invention to provide a pulley system that allows a user to modify the direction of force without affecting the length of the cable within the pulley system.

It is another object of the invention to provide an improved exercise machine.

It is another object of the invention to provide an exercise machine having an improved pulley system.

It is another object of the invention to provide an exercise machine having a pulley system wherein cord tension does not vary substantially as an extension arm of the exercise machine is rotated.

The present invention relates to systems and methods for providing a reorientable pulley system. Implementation of this embodiment may take place in association with a system that includes two pulleys configured to receive a cord and are able to rotate on their corresponding axes. The system further includes a pivoting tube that is employed to house a portion of the cord that extends between the two pulleys, referred to as the intermediate portion of the cord.

For example, one embodiment relates to a pulley system having a tube with a first aperture corresponding to a first, fixed pulley and a second aperture corresponding to a second, rotatable pulley. As the tube is rotated with respect to a support, the rotatable pulley is reoriented from a first position (in relation to the first pulley) to a second position without significantly affecting the intermediate portion of the cord.

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In a further embodiment, the tube includes a first aperture at a first end and a second aperture in a sidewall at an opposing second end. In one embodiment, the tube rotates within a portion of a support located between the first and second apertures of the tube. A first pulley is oriented in relation to the first aperture such that a channel of the rim of the first pulley is configured to receive the cord and is aligned with the hollow passageway of the tube.

A second pulley corresponds to the second aperture such that a portion of the second pulley is positioned within the second aperture to thereby align the channel of the second pulley with the hollow passageway of the tube. Thus, the channels of the first and second pulleys are aligned. In accordance with the present invention, the second pulley may be selectively reoriented in relation to the first pulley while still maintaining the alignment between the hollow passageway of the tube and the channels of the first and second pulleys.

In one embodiment, such as in an exercise machine, the second pulley is coupled to an articulating arm that is coupled to the pivoting tube. The coupling of the pulley to the arm maintains the alignment between the channel of the second pulley and the hollow passageway of the tube when the tube rotates. A cord threaded through the system may be affixed to a load (e.g., a stack of weights) at the first end and pulled at the second end (e.g., by the hand of an exerciser) to enable the lifting of the load. The direction in which the second end of the cord is pulled may be selectively modified by articulating the arm from a first to a second position. However, even after being reoriented to a second position, the second pulley maintains its alignment with the hollow passageway of the tube and the channel of the first pulley.

The intermediate portion of the cord, which extends between the first pulley and the second pulley, is essentially unaffected by the reorientation of the articulating arm since the reorientation simply rotates the second pulley and the tube about the intermediate portion of the

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1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

cord. Furthermore, a reorientation of the arm does not substantially vary the effective cord tension of the pulley system. Finally, the present invention allows for the protection of the cord, provides a convenient single pivot action, and conveniently couples an extension arm directly to the rotating tube.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The features and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

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60 EAST SOUTH TEMPLE
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BRIEF DESCRIPTION OF THE DRAWINGS

In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figure 1 illustrates an exemplary system that provides a suitable operating environment for the present invention,

Figure 2 is an exploded perspective view of a pulley system used at a pivotal connection of the exemplary system of Figure 1.

Figure 2a demonstrates one method for rotatably securing the rotating tube within a cylindrical member.

Figure 3 is a perspective illustration of the pivotal connection of Figure 2 that further illustrates the orientation between a first pulley, a second pulley, and a tube of a reorientable pulley system. The perforated orientation disk 36 of Fig. 2 and a portion of its associated bracket 26 are not shown.

Figure 4 illustrates an end view of the reorientable pulley system of Figure 3 and demonstrates how an intermediate portion of a cord is essentially unaffected as the tube and corresponding pulley are reoriented from a first position to a second position.

Figure 5 is an exploded perspective view of an alternate pulley system used at a pivotal connection of the exemplary system of Figure 1.

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DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to systems and methods for providing a reorientable pulley system. More particularly, one aspect of the present invention relates to a pulley system having (i) a rotating tube; and (ii) a plurality of pulleys associated therewith. A first aperture of the tube corresponds to a first pulley and a second aperture corresponds to a second, rotatable pulley. As the tube is rotated, a rotatable pulley is reoriented from a first position, in relation to the first pulley, to a second position without significantly affecting the intermediate portion of a cord extending across the pulleys.

While the present invention is particularly useful in the area of exercise equipment to couple to a resistance assembly, such as by lifting weight stacks, the systems and methods of the present invention may be used in a variety of different environments and with a variety of different system configurations for lifting a load without significantly affecting the intermediate portion of a cord. Thus, while the following discussion generally relates to an exercise device that includes a reorientable pulley system, the systems and methods of the present invention can be used in a variety of different environments and/or configurations to allow for the direction of the force exerted on a cord to be conveniently modified in a multi-pulley system.

With reference to Figure 1, an exemplary system is illustrated that provides a suitable operating environment for the present invention. In Figure 1, an exercise device, illustrated as exercise device 10, is provided that includes a vertical support 12, a base 14, articulating extension arms 16a-b, and handles 18a-b. Base 14 is coupled to vertical support 12 and provides stability to exercise device 10. Handles 18a-b extend from the distal ends of respective arms 16a-b to allow a user to pull therefrom in order to lift a selectable weight stack (not shown) having a plurality of selectable weights located in vertical support 12. By way of

example, the weight stack may be configured as disclosed in U.S. Patent No. 6,238,323, entitled "Cable Crossover Exercise Apparatus," to Simonson, which is incorporated herein by reference, or in a similar manner.

Thus, a user may select an amount of weight to lift from the weight stack, stand on base 14, and pull handle 18a and/or handle 18b to lift the selected weight amount as part of a weight training workout. In one embodiment, distal members 19a and 19b rotate with respect to respective arms 16a and 16b.

Exercise device 10 is designed to provide a diversity of weight training workouts that focus on various muscle groups, including upper-body muscle groups. Arms 16a-b are pivotally coupled to vertical support 12. Pivotal connection assemblies 20a-b secure arms 16a and 16b in a desired position with relation to vertical support 12 by inserting a pin 22a and/or 22b into a corresponding aperture or location of the available locations 24a and 24b. Thus, a user may independently modify the position of an arm, such as arm 16b, by extricating pin 22b from a current location, pivoting arm 16b to the desired angle with respect to vertical support 12, and inserting pin 22b in the corresponding and desired aperture location 24b. The ability of the exercise device 10 to have one or more arms 16a-b selectively positioned with relation to vertical support 12 enables workout diversity.

The pivoting of arms 16a-b modifies the direction in which the handles are pulled in order to lift the weight stack. For example, when arm 16b is positioned and secured so as to extend in an upward direction from pivotal connection assembly 20b, a user pulls vertically downward on handle 18b in order to lift the weight stack. Alternatively, when arm 16b is positioned and secured so as to extend in a downward direction from connection assembly 20b, a user pulls vertically upward on handle 18b in order to lift the weight stack. Likewise, when

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arm 16b is positioned and secured so as to extend out from pivotal connection assembly 20b, so as to form a right angle with vertical support 12, a user may pull horizontally on handle 18b in order to lift the weight stack. The positioning of arm 16b to modify the direction in which the handles are pulled automatically reorients a pulley in an internal pulley system.

Arms 16a-b and their respective connection assemblies 20a-b and pulley systems are each examples of exercise stations that may be employed in the present invention. However, other exercise stations may be employed that include the pulley system disclosed herein.

With reference to Figure 2, pivotal connection assembly 20b is illustrated in an exploded and perspective diagram. Pivotal connection assembly 20a may be configured in a similar manner, for example. Figure 2 also discloses an example of an internal pulley system that may be employed in the present invention. As provided above, pivotal connection assembly 20b allows arm 16b of the exercise device to pivot and thus be conveniently, selectively positioned in relation to a vertical support.

Pivotal connection assembly 20b comprises a tube 44 rotatably coupled at one end 46 thereof to fixed support 30. Tube 44 is affixed at an opposing end 49 thereof to arm 16. In Figure 2, brackets 26 and 28 are mounted onto a fixed support 30, which is part of the vertical support 12 of Figure 1. Bracket 26 includes a cylindrical portion 27 that corresponds to and extends through an aperture (not shown) within support 30. Bracket 28 receives first pulley 32 and allows pulley 32 to spin thereon about the pulley's axis. Bracket 28 is an example of means for aligning the channel of pulley 32 with the passageway of a tube 44, as will be further discussed below.

In the embodiment of Figure 2, first end 46 of tube 44 is pivotally coupled to cylindrical portion 27. According to one embodiment, first end 46 extends through perforated disk 36,

first bushing 34a, cylindrical portion 27, second bushing 34b and securing ring 45 and pivots within first and second bushings 34a and 34b. The respective outer lips of bushings 34a, 34b abut the opposing edges of cylindrical portion 27 while the remainder of the bushings 34a-b fit within cylindrical portion 27 (see Fig. 2A).

In the embodiment of Figs. 2 and 2A, first end 46 of tube 44 is prevented from sliding out of bushing 34b through the use of a securing ring 45 coupled to the tip of first end 46 once first end 46 is slid through first and second bushings 34b. Securing ring 45 attaches to the tip of first end 46 and abuts bushing 34b, thereby preventing tube from sliding past bushing 34b and out of cylindrical portion 27. In one embodiment, the tip of first end 46 contains a groove 45a configured to receive securing ring 45. With or without the groove, securing ring 45 can also be coupled to first end 46 through welding or adhesion, for example.

Consequently, arm 16b coupled to tube 44 is rotatably secured to support 30. However a variety of different methods may be employed for rotatably securing tube 44 to cylindrical portion 27. For example, in one embodiment, rather than employing a securing ring 45, tube 44 is coupled to the bushings 34a-b, e.g., through welding or adhesion, thereby retaining tube 44 in cylindrical portion. In this embodiment, the combined tube/bushing assembly rotates within cylindrical portion 27.

Perforated orientation disk 36 is mounted onto bracket 26 about the cylindrical portion 27 by connectors, such as bolts, screws, pins, etc., illustrated as connectors 38. In the illustrated embodiment, spacers 40 are mounted on connectors 38 between bracket 26 and disk 36.

Arm 16b includes a weighted end 42 to balance the weight of arm 16b and thus facilitate the selective positioning of arm 16b. As provided above, a pin 22b extends through

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weighted end 42 and is selectively inserted into one of the aperture locations 24b to selectively position and secure arm 16b.

Second end 49 of tube 44 is coupled to arm 16b, such as through welding. Tube 44 is a hollow tube that may be made from a variety of materials such as plastic, metal, or another rigid material, and includes a first aperture located at the first end 46 and a second aperture 48 located in a side wall at opposing second end 49. As indicated above, in the embodiment shown, the first end 46 of tube 44 is inserted through disk 36, through bushing 34a, cylindrical portion 27, and through bushing 34b.

A second pulley 50 is partially inserted into aperture 48 of tube 44. Pulley 50 is mounted onto arm 16b at aperture 52 (e.g., via a pin or bolt), and allowed to rotate on arm 16b. The insertion of a portion of the rim of pulley 50 into aperture 48 aligns the rim channel of pulley 50 with the hollow passageway of tube 44. Thus, arm 16b is an example of a means for aligning the channel of pulley 50 with the passageway of tube 44. Similarly, the mounting of pulley 32 onto bracket 28 aligns the rim channel of pulley 32 with the hollow passageway of tube 44.

A cord 53 having a first end 54 and a second end 55 is used in the pulley system to allow a user to exert a force against a resistance assembly, e.g., by lifting a weight stack of the exercise device. First end 54 of cord 53 can be coupled to the resistance assembly, e.g., a weight stack. The cord 53 is received by the channel rim of pulley 32, which is aligned with the hollow passageway of tube 44. The cord 53 also enters the aperture of tube 44 located at the first end 46, extends along the hollow passageway of tube 44 and is received by the channel rim of pulley 46, where it exits aperture 48, extends along arm 16b and is coupled to handle 18b of Figure 1. Thus, the first end 54 of the cord 53 couples to the weight stack, the second

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end 55 of the cord 53 couples to a handle to be gripped by a user, while an intermediate portion 61 of the cord 53 extends between the pulleys 32 and 50.

The cord 53 represents any elongate member that may be used in a pulley system to lift a load, including a rope, cable, chain, etc., and may include such materials as nylon, leather, rubber, metal, plastic, or another material capable of withstanding the required tension experienced in a given pulley system.

With reference to Figure 3, a perspective view is illustrated of the assembled internal pulley system of Figure 2. As provided above, the pulley system includes pulleys 32 and 50, which are configured to receive cord 53 having first and second ends 54, 55, respectively, and are able to spin on their corresponding axes. As illustrated in Figure 3, the two pulleys are capable of being oriented so as to be transverse in relation to each other. Tube 44 houses a portion 61 (Figs. 2, 4) of the cord 53 that extends between the two pulleys, referred to as the intermediate portion 61 of cord 53.

As mentioned, in the illustrated embodiment, tube 44 includes a first aperture at a first end 46 and a second aperture 48 in the sidewall at opposing second end 49. First pulley 32 is coupled to bracket 28 that is affixed to support 30 and is oriented in relation to the first aperture such that channel 31 located in the rim 33 of first pulley 32 is configured to receive the cord 53, and is aligned with the internal hollow passageway of tube 44.

Second pulley 50 is oriented in relation to the second aperture 48 such that a portion of pulley 50 is positioned within second aperture 48 to thereby align the channel 51 of second pulley 50, which receives the cord 53, with the hollow passageway of tube 44.

The cord 53 can be threaded through the pulley system by placing the cord 53 in the channel 31 of the first pulley 32, extending the cord 53 through the first aperture of tube 44 and

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along the hollow passageway of tube 44, and placing cord 53 on the channel 51 of second pulley 50, thereby extending the cord 53 out of second aperture 48. The cord 53 may be affixed to a resistance assembly at the first end (not shown) and pulled at the second end, which is coupled to handle 18b (Figure 1), to enable the lifting of the load.

As provided above, the direction in which the second end of the cord is pulled may be selectively modified by rotating arm 16b. This rotates tube 44 and correspondingly reorients pulley 50. However, during and after such reorientation, pulley 50 maintains its alignment with the hollow passageway of tube 44. Consequently, intermediate portion 61 of cord 53 is essentially unaffected by the reorientation of the tube and/or pulley and the tension in cord 53 is not significantly affected.

With reference to Figure 4, an end view of the reorientable pulley system of Figure 3 is illustrated to more fully demonstrate how the alignment between the channels of the pulleys and the hollow passageway of the tube is maintained and how the intermediate portion 61 of the cord 53 is essentially unaffected by the reorientation of the tube and/or pulley.

Figure 4 illustrates the pulley system from an end view through end 49 of tube 44, and includes pulley 32 in a vertical position with the channel 31 thereof aligned with the hollow passageway 45 of tube 44. Thus, a cord 53 that is received by the channel of pulley 32 may extend into tube 44.

Pulley 50 is illustrated in a first position 60 in relation to pulley 32. The first position 60 is a horizontal position that creates a right angle between pulleys 32 and 50. As illustrated, a portion of pulley 50 is inserted into aperture 48 to allow the channel 51 of pulley 50 to be aligned with the hollow passageway 45 of tube 44. Thus, the intermediate portion 61 of cord 53 extends along the hollow passageway 45 of tube 44 and is received by the channel 51 of

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pulley 50 in order for cord 53 to extend out of aperture 48 and down arm 16b to handle 18b (See Figure 1).

As provided above, a user may selectively position arm 16b in order to participate in a particular workout. As arm 16b rotates, tube 44 and pulley 50 move with arm 16b since tube 44 and pulley 50 are coupled thereto. Therefore, as a user rotates arm 16b, the relationship between the hollow passageway 45 of tube 44 and the channel of pulley 50 is maintained. This is illustrated in Figure 4 as arm 16b is rotated from a first transverse position 60 to a second transverse position 62. In the second transverse position 62, the inside angle between pulley 50 and pulley 32 is increased, yet the channel 51 of pulley 50 and the hollow passageway 45 of tube 44 remain aligned.

Therefore, as arm 16b is selectively repositioned, tube 44 and pulley 50 rotate about the intermediate portion 61 of cord 53. As such, the intermediate portion 61 of cord 53 is essentially unaffected as the angle between pulley 32 and pulley 50 is modified. Hence, the length of cord 53 is not substantially affected during reorientation of arm 16b. Thus, the handles 18a-b remain in a constant position with respect to respective arms 16a-b despite the reorientation of arms 16a-b.

The placement of a pulley (e.g., second pulley 50) partially within a tube such as tube 44, and the extension of the cord 53 out of second aperture 48, provides for the protection of cord 53, can assist to assure that the cord 53 does not slip off the pulley, and enables convenient coupling of the extension arm 16b directly to tube 44 such that arm 16b pivots in an uncomplicated manner along a single pivot axis.

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However, embodiments of the present invention embrace a variety of system configurations that allow for and maintain an alignment between a channel of a first pulley, a channel of a second pulley, and the hollow passageway of a tube located therebetween.

For example, as shown in an exploded view in Figure 5, in one embodiment a first pulley 32 is coupled to a first bracket 28 that is affixed to a support 30. A second pulley 50 is rotatably coupled to an arm 16b that is in turn coupled to a tube 44a, which includes a first aperture at a first end 46a and a second aperture 48a at the opposing second end 49a. The tube 44a extends between the two pulleys and, upon assembly, the hollow passageway of the tube 44a is aligned with the channels of the two pulleys 32, 50. A cord 53 may therefore be received by the channel of the first pulley 32, enter the first aperture of the tube 44a, extend along the hollow passageway of the tube 44a, extend out of the second aperture 48a, and be received by the channel of the second pulley 50. By way of example, the tube 44a may be able to rotate within a sleeve 27 that is coupled, directly or indirectly, to the support 30. As the tube 44a rotates, the second pulley 50 also rotates about the intermediate portion 53 of the cord and the alignment between the second pulley 50 and the hollow passageway of the tube 44a is maintained since the second pulley 50 and the tube 44a are coupled by the arm 16b.

Figure 5 is an exploded perspective view of an alternate pulley system used at a pivotal connection of the exemplary system of Figure 1. In the embodiment of Figure 5, end 49a of tube 44a is coupled to arm 16b at connection point 70, such as through welding, the aperture 48a at end 49a is not in a sidewall, and pulley 50 is not positioned within tube 44a, but instead remains outside during use, as shown. In one embodiment, the remaining features of Figure 5 are the same as or similar to those discussed above with reference to Figure 2.

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Upon assembly in the embodiment of Figure 5, there is an alignment between the hollow passageway of the tube 44a and the respective channels of the first and second pulleys 32, 50. Furthermore, second pulley 50 may be selectively reoriented in relation to the first pulley 32 while still maintaining an alignment between the hollow passageway of the tube 44a and the respective channels of the first and second pulleys 32, 50.

Arm 16b is an example of a means for aligning the channel of pulley 50 with the passageway of tube 44a. Just as a mechanism such as taught in Figure 2 may be employed in conjunction with arm 16a and/or 16b, a mechanism such as taught in Figure 5 may be employed in conjunction with arm 16a and/or 16b, for example, or other arms.

Thus, the systems and methods of the present invention may relate to a reorientable pulley system having a tube, a first pulley and a second pulley, wherein the second pulley may be selectively reoriented in relation to the first pulley while still maintaining an alignment between the hollow passageway of the tube and the channels of the first and second pulleys. The reorientation of the second pulley essentially does not affect the intermediate portion of the cord, which extends from the first pulley to the second pulley, since the reorientation simply rotates the second pulley and the tube about the intermediate portion of the cord. Furthermore, the effective cord tension does not vary significantly as the second pulley is reoriented. In addition, the systems and methods of the present invention allow for a modification of the direction of the force exerted in a pulley system without causing the cord to bind in the system and without having to individually adjust the pulleys.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore,

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indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed and desired to be secured by United States Letters Patent is:

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